AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (Previously Presented) An optical network comprising:

sections for establishing optical paths using Open Shortest Path First-Traffic Engineering (OSPF-TE) as a routing protocol and Resource reSerVation Protocol-Traffic Engineering (RSVP-TE) as a signaling protocol, for Generalized Multi-Protocol Label Switching (GMPLS);

a plurality of optical edge routers for connecting external IP networks to the optical network; and

a plurality of optical cross connects, for connecting the optical edge routers by the optical paths, having switching sections with respect to an optical path unit, wherein

each of the optical edge routers has both of:

an IP network instance for maintaining a routing table in each of the external IP networks and activating routing protocols between the external IP networks and the IP network instance; and

an optical network control instance for maintaining topology information in the optical network and switching/signaling the optical paths based on at least one of topology and routing information for the external IP networks learned from the activated routing protocols,

wherein Border Gateway Protocols (BGPs) are used for protocols for exchanging the route information of the external IP networks,

wherein the optical paths are wavelength paths, and

wherein the optical network control instances are provided so as to be used by all the external IP networks, and

wherein the IP network instances corresponding to all the external IP networks are provided independent of each other.

2 – 4. (Cancelled)

5. (Currently Amended) A computer program, embedded in a non-transitory computer readable medium, used for an optical ~~networks~~ network and optical edge routers having sections for predetermined calculations and sections for transmitting packets between the section for predetermined calculations and external IP networks, wherein the section for the predetermined calculations comprises functions of:

exchanging route information between neighboring routers in the external IP networks;

producing a routing table and storing the produced routing table in a storage section;

controlling switching of the optical paths based on at least one of topology and routing information in the storage section regarding the external IP networks;

collecting topology information inside the optical ~~networks~~ network and storing the collected topology information in the storage section using Open Shortest Path First-Traffic Engineering (OSPF-TE) as a routing protocol;

signaling so as to establish/release the optical paths using Border Gateway Protocol (BGP);

notifying route information to other optical edge routers which face an optical edge router; and

reading out the routing tables and the topology information from the storage sections and producing a packet forwarding table which sets where the packets are to be transmitted to by the section for transmitting the packets,

wherein the optical paths are wavelength paths,

wherein the function of exchanging the route information and the function of producing the routing table provide an IP network instance of the optical edge router,

wherein the function of controlling the switching, the function of collecting the topology information, the function of signaling, and the function of notifying the route information provide an optical network control instance of the optical edge router,

wherein the optical network control instance is provided so as to be used by all the external IP networks, [[and]]

wherein the IP network instance is provided independent of IP network instances of the other optical edge routers corresponding to other external IP networks, and

wherein the optical edge routers are provided in the optical network that is provided independent of the external IP networks.

6. (Previously Presented) A cutting-through method for direct communication by a plurality of edge routers for connecting a core network and a plurality of external IP networks mutually at border points of the core network and the external IP networks, comprising:

maintaining lists, in which ingress-side IP address correspond to identifiers for showing egress edge routers, in ingress edge routers;

adding the identifiers corresponding to the ingress-side IP address to the IP packets by the ingress edge routers when IP packets are transmitted;

maintaining a relationship between identifiers and outgoing interfaces in the egress edge routers;

retrieving the outgoing interfaces corresponding to the identifiers added to the IP packets by using the added identifiers as a key in the egress edge routers, wherein Multi-Protocol Label Switching (MPLS) labels are used for the identifiers;

transmitting the IP packets to the retrieved outgoing interfaces; and

controlling switching of optical paths in the core network based on at least one of topology and routing information in the maintained lists regarding the external IP networks, wherein the core network and the external IP networks are optical networks in which edge routers are connected directly by optical paths,

wherein correspondence information with respect to the ingress-side IP address and its corresponding identifiers are exchanged among the edge routers by control signals and

wherein the optical paths are wavelength paths.

7 – 11. (Cancelled)

12. (Previously Presented) A computer program, embedded in a non-transitory computer readable medium, installed to an information processing apparatus, for realizing functions corresponding to edge routers, the functions being inputting functions, for connecting a core network and a plurality of external IP networks at border points mutually and handling incoming IP packets inputted from the external IP networks to the core network; and outputting functions, for handling outgoing IP packets outputted from the core network to the external IP networks, wherein,

the inputting functions serve for:

a function for maintaining lists in which ingress-side IP addresses correspond to identifiers for showing other egress edge routers; and

a function for adding the identifiers corresponding to the ingress-side IP addresses of the IP packets to the IP packets in accordance with the lists when the IP packets are transmitted to other edge routers, and

the outputting function serves to maintain a relationship between identifiers and outgoing interfaces, retrieve the outgoing interfaces corresponding to the identifiers added to the IP packets by using the added identifiers as a key, and transmit the IP packets to the retrieved outgoing interfaces, wherein Multi-Protocol Label Switching (MPLS) labels are used for the identifiers and

the core network and the external IP networks are optical networks in which edge routers are connected directly by optical paths, further comprising a function

for controlling the optical paths in the core network based on at least one of topology and routing information in the maintained lists regarding the external IP networks and a function for exchanging information, in which the ingress-side IP addresses correspond to the identifiers, among other edge routers mutually by control signals, and wherein the function for maintaining the lists serves for generating or updating the lists in accordance with the information obtained by the exchanging section with respect to the correspondence information between the ingress-side IP addresses and the identifiers,

wherein the optical paths are wavelength paths.

13 – 15. (Cancelled)

16. (Previously Presented) An information transmission network system, having a plurality of line exchangers and a plurality of packet exchangers, for setting communication lines among the packet exchangers, the line exchangers and the packet exchangers being connected by communication lines, wherein,

the line exchangers have a line switch and a section for controlling line paths;

the line switch has a function for connecting the communication lines to the line exchangers based on a topology of the communication lines among the packet exchangers;

each of the packet exchangers, connected to the line exchangers, has a packet switch, a section for controlling line paths, a section for controlling packet paths, and a cooperative control section;

the packet switch has functions for selecting communication lines for transmission and outputting in accordance with packet-ingress-side's information transmitted via the communication lines;

the sections for controlling line paths in the line exchangers are connected to the sections for controlling line paths in other line exchangers via lines the among line exchangers;

the sections for controlling line paths in the packet exchangers are connected to at least the sections for controlling line paths in the line exchangers via lines among the packet exchangers and the line exchangers;

the sections for controlling line paths in the line exchangers and the sections for controlling line paths in the packet exchangers have a function for acknowledging line connection conditions in a line-exchanging-network, by exchanging information of the communication conditions among the communication lines;

the section for controlling packet paths acknowledges connection-related-information with respect to packet exchange among the packet exchangers connected via the communication lines, by exchanging the information for the packet paths via the communication lines, and determines the communication lines for output in accordance with the packet-ingress-side's information;

the cooperative control sections have functions for receiving instructions regarding new communication lines, referring to two pieces of connection information, with respect to line-exchanging-network, collected by the section for controlling line paths, and connection information with respect to packet-exchange collected by the section for controlling packet paths, selecting paths, being used for the new

communication lines, and instructing the section for controlling line paths to set paths being used for the new communication lines; and

the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed paths so that the line exchangers, receiving the messages for controlling and setting the connected lines, set up the communication lines, and sending control messages to the line exchangers for setting the lines in accordance with the instructed paths, wherein the communication lines are Multi-Protocol Label Switching-Label Switch Path (MPLS-LSP) lines, and Open Shortest Path First-Traffic Engineering (OSPF-TE) is used as a communication protocol for the communication lines,

wherein the information transmission network system, for setting the communication lines among the packet exchangers and packet/line exchangers, has packet/line exchangers in which the packet exchangers and the line exchangers are integrated.

17. (Cancelled)

18. (Previously Presented) A packet exchanger in an information transmission network system, having a plurality of line exchangers and a plurality of packet exchangers, for setting communication lines among the packet exchangers, comprising:

a packet switch having a function for selecting communication lines used for transmittance, in accordance with packet-ingress-side's information transmitted by the communication lines and outputting;

at least one section for controlling line paths in the line exchangers, connected to the communication lines among the packet exchangers/line exchangers, for exchanging connection information of the communication lines and acknowledging line connection condition in a line-exchanging-network, based on a topology of the communication lines among the packet exchangers;

a section for controlling packet paths having functions for acknowledging connection-related-information with respect to packet exchange by exchanging information of the packet paths via the communication lines among the packet exchangers connected via the communication lines, and determining the communication lines for output; and

a cooperative control section having a function for receiving instructions by new communication lines, referring to two pieces of connection information, with respect to the line-exchanging-network, collected by the section for controlling line paths, and connection information with respect to the packet exchange collected by the section for controlling packet paths, selecting paths used for the new communication lines, and instructing the section for controlling line paths to set paths used for the new communication lines; wherein

the section for controlling line paths have functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed paths so that the line exchangers receive the messages for controlling and setting the

connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths, wherein the communication lines are Multi-Protocol Label Switching-Label Switch Path (MPLS-LSP) lines, and Open Shortest Path First-Traffic Engineering (OSPF-TE) is used as a communication protocol for the communication lines.

19. (Previously Presented) A packet/line exchanger in an information transmission network system, having a plurality of line exchangers and a plurality of packet exchangers, for setting communication lines among the packet exchangers, comprising:

line switches having a function for connecting the communication lines to the line exchangers based on a topology of the communication lines among the packet exchangers;

a packet switch having function for selecting communication lines used for transmittance, in accordance with packet-ingress-side's information transmitted by the communication lines and outputting the same;

at least a section for controlling line paths in the line exchangers, connected to the communication lines among the packet exchangers/line exchangers, for exchanging connection information of the communication lines and acknowledging line connection conditions in a line-exchanging-network;

a section for controlling packet paths having functions for acknowledging connection-related-information with respect to packet exchange by exchanging information of the packet paths via the communication lines among the packet

exchangers connected via the communication lines, and determining a communication line for output; and

a cooperative control section having a function for receiving instructions by new communication lines, referring to two pieces of connection information, with respect to the line-exchanging-network, collected by the section for controlling line paths, and connection information with respect to the packet exchange collected by the section for controlling packet paths, selecting paths used for the new communication lines, and instructing the section for controlling line paths to set paths being used for the new communication lines; wherein

the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed path, instructed by the cooperative control section, so that the line exchangers, receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths, wherein the communication lines are Multi-Protocol Label Switching-Label Switch Path (MPLS-LSP) lines, and Open Shortest Path First-Traffic Engineering (OSPF-TE) is used as a communication protocol for the communication lines.